

# THE STATUS OF CORAL REEFS IN JORDAN - 2000

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## Executive Summary

The Jordanian coastline extends approximately 27 km along the north eastern-reaches of the Gulf of Aqaba. Approximately 30 % of the coast is used for port Fringing reefs border up to 50 % the coast supporting a high diversity of coral and associated fauna (158 coral species in 51 genera and over 280 fish species).

Jordan's coral reefs are in good condition, supporting up to 90 % cover of scleractinian corals. No bleaching events were recorded in the aftermath of the 1997/1998 global warming event, possibly as a result of the extreme northern latitudes.

There are no existing marine protected areas in Jordan, although the area within the Marine Station grounds is *de facto* a protected area. The Aqaba Coral Reef Protected Area is the only proposed protected, which will enclose an undefined areas of diverse reefs and associated fauna at the northern tip of the Gulf of Aqaba. In recent years Jordan has revised its legal and regulatory framework for environmental protection at a national and international level. The country is party to eight international conventions or treaties which directly or indirectly have an impact on the conservation of coral reefs.

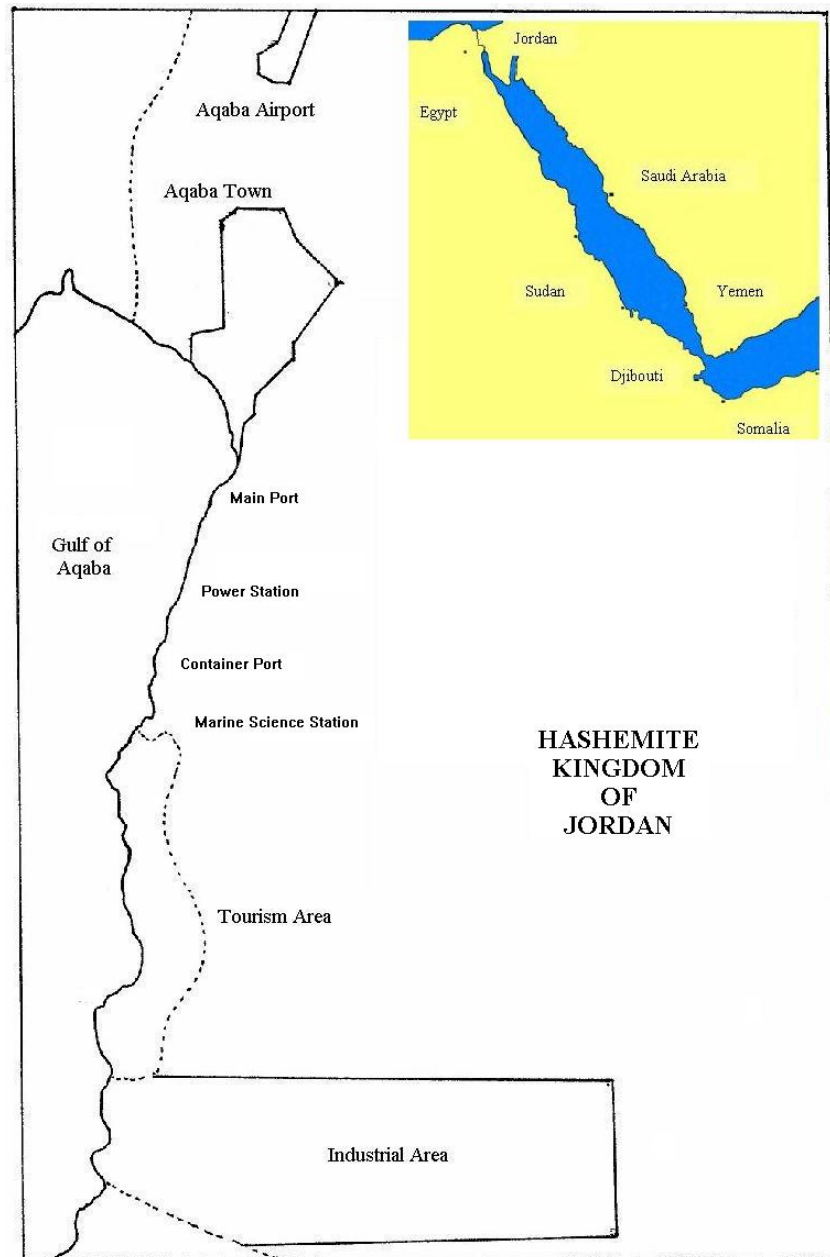
The Gulf of Aqaba is highly susceptible to pollution. At present pollution is limited and localised. The main threats are oil spills and discharges, industrial discharges, municipal and ship-based sewage and solid waste. The development of the tourism sector might also further threaten the coral reefs.

To improve the conservation status of coral reefs in Jordan, there is a need to strengthen the overall institutional capabilities of Jordanian government agencies through hiring and training of staff, the implementation of environmental protection laws and regulations, and improving regional cooperation to co-ordinate and enhance the efforts of individual Gulf-bordering nations. Several additional measures are also needed, including the development of an integrated coastal zone management strategy, capacity building at both the legislative and management and operation levels, the establishment of a Marine Protected Area and the harmonisation of existing regulations at a national and international level.

## 1. Introduction

The coastline of the Hashemite Kingdom of Jordan extends approximately 27 km along the north eastern-reaches of the Gulf of Aqaba (Fig. 1). The coast is home to Jordan's only seaport and is a center of industry, tourism and transportation. Approximately 30 % of the coast is used for port facilities.

The climate in the region is arid with an annual rainfall of 20 - 30 mm and mean daily air temperatures ranging from 14 to 32 °C. The Gulf of Aqaba is a semi-enclosed system with limited water circulation (residence time of two to three years).



**Fig. 1: Map of Jordan's Aqaba region and land use patterns.**

Fringing reefs border up to 50 % the coast supporting a high diversity of coral and associated fauna. It has been reported that the reefs support 158 coral species in 51 genera (Al-Moghrabi 2000) and over 280 fish species (PERSGA 1996). Jordan's coral reefs are in good condition, supporting up to 90 % cover of scleractinian corals. No bleaching events were recorded in the aftermath of the 1997/1998 global warming event, possibly as a result of the extreme northern latitudes.

Pollution from industry, primarily in the form of phosphates and fertilisers, constitute the major threats to coral reefs. The influx of nutrients smothers the coral polyps and promotes

the overwhelming growth of opportunistic species such as *Stylophora pistillata*, which ultimately alters the ecological balance on the reefs. The slow water circulation patterns in the Gulf of Aqaba exacerbate these problems. Natural impacts on coral reefs include predation, such as that from *Drupella cornus*, disease and extreme low tides.

There are currently no marine protected areas in Jordan, although one is proposed that will encompass coral reefs at the northern tip of the Gulf of Aqaba, through funding by a GEF-Jordan initiative.

Coral reef conservation in the Gulf of Aqaba will only come about by limiting the effects of industry, maritime activities and tourism. Several efforts are underway to develop regulatory and institutional mechanisms for promoting sustainable development in the Aqaba region.

## **2. Methods**

Current research involves studies on the coral communities near the fertiliser industries as a critical site and along the entire coastline as a national programme, in particular the monitoring of biological and physical characteristics including currents, temperature, and nutrients levels. Studies also are aimed at identifying temporal and spatial changes in reef structure, coral coverage and fish population diversity and density, and address the impact of industry, diving and tourism.

## **4. Status of Coral Reefs – Benthos and Fish**

### **i. Summary**

Little current research data is available for Jordan's reefs. The reefs are in relatively good condition, with over 90 % coral cover, and no evidence of bleaching was observed after the 1997/1998 climatic event.

### **ii. Coral Health**

A high number (212 / m<sup>2</sup>) of muricid gastropods *Drupella cornus* were recorded in 1994. Black band disease was also found to infect 61 colonies in a survey area of 10 m diameter at reefs near the Industrial Area, and only 6 colonies in a similar sample in the *de facto* protected area immediately offshore from the Marine Science Station in 1997. The reef flats are subjected to extreme low tides which dry out the entire zone during February and September each year.

### **iii. Coral Cover**

### **iv. Fish Communities**

## **5. Status of Coral Reef Fisheries**

The fishing industry in Aqaba is small and artisanal, consisting of approximately 85 fishermen and 40 boats (1995 data). Total catch in 1995 was 15 mt, down from the 103 mt recorded for 1993 and the maximum of 194 mt in 1966. There are no cold storage facilities

and catches are sold upon landing (PERSGA 1996). Recreational SCUBA divers are reported to collect a small number of aquarium fish, but no indications of volume are available.

## **6. Threats to Coral Reef Biodiversity**

### **i. Summary**

The Gulf of Aqaba is highly susceptible to pollution. At present, however, pollution is limited and localised. The main threats are oil spills and discharges, industrial discharges, municipal and ship-based sewage and solid waste. The development of the tourism sector might also further threaten the coral reefs.

### **ii. Fertiliser Discharges**

Aqaba's main manufacturing facility is the Jordan Phosphate Mines Company (JPMC) fertiliser plant in the Industrial Area, producing 740,000 mt of diammonium phosphate (DAP) and 432,000 mt of phosphoric acid annually. The fertilisers account for 10 % of Jordan's annual export commodities. A second plant is under construction (Nippon Jordan Fertiliser Company) which will increase this industry sector significantly with an estimated production of 300,000 mt of nitrogen-phosphorus-potassium (NPK) fertiliser destined for the Japanese market. A concern is the cooling discharge (warm, chlorinated brine) which is released 140 m from shore at a depth of 30 m. Small quantities of sulphur and DAP are routinely spilled during ship loading operations.

### **iii. Power Generation**

The Jordan Electrical Authority operates two power stations (260 megawatts and 14 megawatts), and is constructing a third (130 megawatts). The primary concern in these power generation installations is high volume of cooling water discharges (warm, chlorinated brine). At present some 38,000 cubic meters / hour are discharged 200 m from shore at a depth of 20 m. Discharge water is 3 °C above ambient temperature.

### **iv. Port Related Activities**

The Port of Aqaba is a major regional shipping center (second only to Suez and Jeddah). From 1989 to 1993 over 2300 vessels entered the port, and current plans aim to double the volume by 2000. Rock phosphate is the primary export, ranging in volume from 3.6 to 6.4 million mt during 1989 to 1993. In the same period, 1.2 to 1.4 mt of potash, and 0.4 to 0.7 mt of phosphate fertiliser were also handled. One concern is the possibility of reef-damaging runoff from an accumulated stockpile of fluorine-containing gypsum during flash floods. Waste oil is occasionally discharged from bulk cargo transport trucks in sensitive tidal areas, eventually reaching the sea.

### **v. Tourism**

Tourism is an important sector of Jordan's economy. The number of tourists has risen steadily over the last two decades, with over 1.5 million people in 1995. Although tourism has not reached the levels attained in neighbouring Egypt and Israel, the number of divers rises steadily each year. Current operations are able to handle 160 divers per day, with direct destruction occurring through walking on exposed reefs, souvenir collection, aquarium fish collection flipper damage and anchor damage.

### **vi. Oil Pollution**

The ports in Aqaba have no reception facilities for oil-contaminated bilge or ballast water. Contamination risks come from small spills from bilge or ballast water from freighters (0 - 2 mt); spills from bilge or ballast water from oil tankers (2 - 20 mt); release of oil as a result of defective equipment or procedures (100 mt); major spills from bunker tank . vessel rupture (> 500 mt); complete sinking of cargo vessels (> 1,500 mt), tanker collisions (> 7,500 mt) and even wreckage of fully loaded tankers (>100,000 mt). Given the Gulf of Aqaba's slow cycling period, oil spills might remain in the local waters for several years, with a severe risk to coral reefs through smothering or polyp uptake of hydrocarbons.

#### **vii. Sewage**

Discharges into the Gulf of Aqaba have resulted in the proliferation of algae, limiting coral growth in the northern reefs. Sewage from the 1.2 million passengers who use the Arab bridge Marine Company vessels is discharged directly to the sea.

### **7. Marine Protected Areas (MPAs) and Level of Management**

#### **i. MPAs Declared**

There are no existing marine protected Areas in Jordan.

#### **ii. *de facto* and planned MPAs**

The Aqaba Coral Reef Protected Area is the only proposed protected area for Jordan. It will enclose an undefined areas of diverse reefs and associated fauna at the northern tip of the Gulf of Aqaba. The MPA will be developed through a GEF-Jordan initiative to curb the pressures from reef fisheries, and recreational and industrial development.

### **8. Current and Potential Climate Change Impacts**

### **9. Current Monitoring and Management Capacity to Conserve Coral Reef Resources**

#### **i. Monitoring Capacity**

The Water Authority of Jordan (WAJ) is responsible for monitoring industrial discharges on a semi-monthly basis to ensure compliance with Jordan Standard Specifications (212). To date, monitoring has not taken place at this frequency, and enforcement actions based on JSS 212 are rare. At present, no standards or guidelines are currently in force regarding the treatment of sewage sludge under the Jordan Standard Specifications (893), which sets maximum limits for pollutants in sewage plant discharges.

The Aqaba Marine Science Station (MSS) monitors trends on coral reefs and provides facilities for training and research. Studies are conducted on water quality, impacts of pollutants and baseline coral reef ecology. MSS also administers the Aqaba Marine Science Center which occupies 500 m of the coastline (*de facto* protected).

Three NGOs also address marine environmental concerns in Aqaba: The Royal Society for the Conservation of Nature, which funds an inspector to patrol merchant vessels; the Jordan Environment Society, which introduces awareness programmes, and; the Jordan Royal

Ecological Diving Society, which organises underwater cleanups, awareness programmes and monitoring of coral reefs.

## **ii. Management Capacity**

The responsibility for development of the Aqaba region is borne by the Aqaba Regional Authority (ARA), with conservation works carried out through the ARA Environment Unit (established in 1994). ARA supervises town planning, tenders and public works, finance, administration, regional planning and research and studies.

The Ports Commission is responsible for construction, operation and maintenance of Aqaba port facilities. The commission also addresses environmental protection concerns, and through its Marine Department, the safety of shipping operations. This department does not monitor environmental law compliance of ships, but if ships are observed discharging oil the Department works with the Royal Jordanian Navy, which conducts patrols of port areas and in the anchorages, to keep vessels in custody until the case is heard in a court of law. Court hearings invariably take place within 48 hours but fines only range from USD 1,000 to 16,000. No cases were heard between 1993 and 1995.

## **10. Government Legislation, Strategies and Policy Pertinent to Reef Conservation**

### **i. Summary**

In recent years Jordan has improved the legal and regulatory framework for environmental protection at a national and international level. The country is party to eight international conventions or treaties which directly or indirectly have an impact on the conservation of coral reefs.

### **ii. International Agreements**

Jordan is party to eight international conventions which are relevant to the conservation of coral reef resources. These are the International Convention for the Prevention of Pollution of the Sea by Oil, the Convention of the Prevention of Marine Pollution by Dumping Wastes and other Matter (London Convention), the Convention on International Trade in Endangered Species of Wild Fauna or Flora (CITES), the International Convention for the Prevention of Pollution from Ships (MARPOL); the Regional Convention for the Conservation of the Red Sea and the Gulf of Aden Environment (Jeddah Convention); the Convention for the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (Basel Convention); the United Nations Convention on Biological Diversity (CBD); and the United Nations Framework Convention on Climate Change.

The Middle East peace process and the opening up of relations between Jordan and Israel have also created commitments for regional cooperation on a range of environmental issues.

### **iii. National Legislation**

A number of national laws exists that directly or indirectly are pertinent to reef conservation, in particular the Law of Environmental Protection and several Articles within (Table I).

**Law of the Aqaba Region Authority No. 7 (1987)** - Delegates the power to plan and execute tourism, industrial and agricultural projects in the region. The Law has been the key

instrument for strengthening environmental controls including the use of EIAs and coastal zone management guidelines. Regulations for the Jordanian Red Sea Marine park are being developed under this Law.

**Law of the Environmental Protection No. 12 (1995)** - Establishes a national framework for environmental policy, including the formation of a Higher Council for Environmental Protection (HCEP). The HCEP sets national environmental policy and reviews proposed laws, specifications and standards prepared by the General Corporation for Environmental Protection (GCEP). The GCEP implements pollution prevention regulations including inspection and monitoring. The Law also harmonises existing laws and settles jurisdictional conflicts.

**Law of Environmental Protection (Article 35)** - Bans the removal, damage to and use of corals and shellfish from the Gulf of Aqaba.

**Jordan Standard Specifications No. 212 (1982 updated 1991)** - Establishes maximum allowable limits for pollutant use and discharges into streams, *wadis* or the sea, and includes standards for the protection of aquatic life.

**Jordan Standard Specifications No. 893 (1994 updated 1995)** - Sets maximum limits for pollutants in sewage plant discharges, which include publicly owned waste water works operated by the WAJ.

**Shipping Law No. 51 (1961)** - Bans ships from dumping soils, stones, sand, scum, toxic and chemical waste or any other material into the sea. Spills which occur during the loading and unloading of ships are also classified under this Law.

**Aqaba Port Quarantine Law No. 32 (1972)** - Bans the discharge of ship-based pollution including bilge water. The Law may impose fines and order remediation works.

**Agricultural Law No. 20 (1973)** - Issues fishing licences and prohibits the removal of corals.

**Table I: national Laws and Regulations pertinent to coral reefs** (Source: PERSGA 1996).

<i>National Laws and Regulations</i>	<i>Year (in force)</i>	<i>Government Agency Concerned</i>
Law of the Environmental Protection No. 12	1995	Higher Council for Environmental Protection General Corporation for Environmental Protection
Jordan Standard Specifications No. 893	1994	Water Authority of Jordan
Jordan Standard Specifications No. 212	1982	Water Authority of Jordan
Law of the Aqaba Region Authority No. 7	1987	Aqaba Region Authority
Port Services Fees Law No. 49	1976	Ports Corporation
Port Services Fees Law No. 20	1987	Ports Corporation
Agricultural Law No. 20	1973	Ministry of Agriculture
Aqaba Port Quarantine Law No. 32	1972	Ports Corporation
Shipping Law No. 51	1961	Ports Corporation

## **11. Gaps in Capacity and Requirements for Improved Conservation.**

### **i. Summary**

Most of Jordan's departments and organisations appear to be reasonably well staffed. Certain areas including coastal zone management and computerisation need to be strengthened to meet the demands of effective development and implementation of legislature, and for the establishment of a Marine Park.

### **ii. Institutional Capacity Building**

A training program should be developed and implemented to strengthen the capacity to regulate industrial performance. Essential for the development of this program are an industrial pollution prevention specialist and an environmental monitoring technician. The industrial pollution prevention specialist will implement the new permitting process, conduct facility inspections and review specific industry documents and practices relevant to control of industrial pollution. The environmental monitoring technician will be responsible for collection and analysis of both air and water samples. At the same time, the coastal zone management efforts need strengthening to integrate current conservation measures with development plans.

### **iii. Computer / GIS Database Capability**

Determine the information technology appropriate to support the work of the ARA Environment Unit. The information technology system chosen must be designed to promote planning, monitoring and enforcement actions. This initiative must acquire a computer / GIS system and conduct staff training in information technology applications to specific projects.

## **12. Recommendations to Improve the Conservation of Coral Reef Resources.**

### **i. Summary**

The following are aimed at strengthening the overall institutional capabilities of Jordanian government agencies through hiring and training of staff, the implementation of environmental protection laws and regulations, and improving regional cooperation to coordinate and enhance the efforts of individual Gulf-bordering nations. Jordan has improved its capacity for environmental protection through the establishment of the new national environmental law, the creation of the ARA Environment Unit, and the work of the GEF Project Preparation. Several additional measures are needed if coral reefs are to be protected which include the development of an integrated coastal zone management strategy, capacity building at both the legislative and management and operation levels, the establishment of a Marine Protected Area and the harmonisation of existing regulations at a national and international level.

### **ii. Pollution**

Develop and implement marine vessel pollution prevention and control standards and regulations. To meet its obligations under MARPOL, Jordan is expected to develop and implement standards and regulations for management of oily waste (bilge and ballast water and tank washings), noxious liquid substances, solid waste, and sewage.

### **iii. Waste Handling**



Develop bilge and ballast water reception facilities. These should be designed for waste oil collection, recovery and reuse. The option of establishing a co-ordinated (Jordan-Egypt-Israel) waste oil recovery scheme should be assessed.

#### **iv. Oil Spills**

Prepare for small to moderate oil spills through the establishment of oil spill response centers in Nuweiba (Egypt), Eilat (Israel) and Aqaba. The present contingency project targeting spills of up to 600 metric tons of oil leaves unaddressed the risk of a potentially catastrophic spills (up to 150,000 metric tons) from tanker collision or grounding.

#### **v. Coastal Zone Management Plan Implementation**

Adopt and implement regulations, standards, coastal zone management and environmental auditing procedures for coastal industries, including adoption and implementation of guidelines for industrial pollution prevention. This effort should monitor air and water discharges, compile and analyse inspection data, review industrial emergency preparedness plans, and assist industries in the preparation of industrial environmental audits.

#### **vii. Monitoring Marine Water Quality**

A monitoring project is needed to assess current marine water quality, and to establish measures for maintaining and improving water quality. The monitoring program must include monthly baseline testing to assess the horizontal and vertical distribution and movement of nutrients, inorganic components, algae, oxygen, salinity, and other parameters.

#### **vii. Legislation and Implementation**

Implement Coastal Zone Management and Environmental Impact Assessment Procedures. Establish and implement guidelines for new construction co-ordinated with requirements that may be developed by the GCEP, and develop the capacity to implement new regulations.

#### **viii. Gulf of Aqaba Marine Park**

Develop legislation and a management plan for a multi-use marine park (MP) in Jordan, including regulations governing different user activities (e.g. motorised and non-motorised boating, SCUBA diving, snorkelling, swimming fishing, beach recreation); installation of boundary demarcations for different user zones within the MP, including mooring and marker buoys, terrestrial fencing, floating platforms, reef crossovers, and informational signs; a detailed operating budget incorporating user fees and other means of financing ongoing MP operations; and a public information and awareness program, including printed information brochures for different user categories and audio-visual presentations for use at a visitor center, in regional hotels, and in public school and adult educational settings.

## **Appendix I – References**

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- PERSGA, 1996. Strategic Action Plan for the Red Sea and Gulf of Aden: Hashemite Kingdom of Jordan country report. Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden, Jeddah. 36pp.

## Appendix II – Names and Addresses of Key Contacts for Jordan

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**Appendix IV - Acknowledgements**

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